

What is claimed is:

- 3.6 A1)
1. A method comprising:
converting a gamut in a first color space to a gamut in a second color space;
converting the gamut in the second color space to a gamut in a third color space;
5 rescaling a lightness component of a gamut value in the third color space to form
a modified gamut; and
converting the modified gamut to a second gamut in the second color space.
 2. The method of claim 1, wherein rescaling a lightness component of a gamut value
10 in the third color space to form a modified gamut comprises:
modifying the gamut in the third color space by changing a lightness component
of a color value in the third color space such that an upper surface of the gamut in the first
color space is preserved and a lower surface of the gamut in the first color space is
mapped to a bottom surface of the gamut of the second color space to form an expanded
15 gamut in the third color space.
 3. The method of claim 2, wherein converting a gamut in a first color space to a
gamut in a second color space comprises:
applying a black generation method to the gamut in the first color space to form
the gamut in the second color space.
 - 20 4. A method comprising:
converting a gamut in a CMY color space having an upper surface and a lower
surface to a gamut in a CMYK color space having a bottom surface;
converting the gamut in the CMYK color space to a gamut in a CIELAB color
space, the gamut in the CIELAB color space having a lightness component;
25 modifying the gamut in the CIELAB color space by changing the lightness
component such that the upper surface of the gamut in the CMY color space is preserved
and the lower surface in the CMY color space is mapped to the bottom surface of the

gamut of the CMYK color space to form a gamut in an expanded CIELAB color space;
and

transforming the gamut in the expanded CIELAB color space to form a second
gamut in the CMYK color space.

- 5 5. The method of claim 4, wherein converting a gamut in a CMY color space having
an upper surface and a lower surface to a gamut in a CMYK color space having a bottom
surface comprises:

applying a black generation method to the gamut in the first color space to form
the second gamut in the CMYK color space.

- 10 6. The method of claim 5, wherein applying a black generation method to the gamut
in the first color space to form the second gamut in the CMYK color space comprises:

applying Gray Component Replacement (GCR) to the first gamut in the first color
space to form the gamut in the second color space.

- 15 7. A method comprising:

modifying a CIELAB gamut having an L^* component to form a modified
CIELAB gamut; and

converting the modified CIELAB gamut to a color control space gamut subject to
K constraints and TAC constraints.

- 20 8. The method of claim 7, wherein modifying the CIELAB gamut having an L^*
component to form a modified CIELAB gamut comprises:

linearly rescaling the L^* component of the CIELAB gamut to form the modified
CIELAB gamut.

- 25 9. The method of claim 7, wherein converting the modified CIELAB gamut to a
color control space gamut subject to K constraints and TAC constraints comprises:

generating an inverse function of a forward function, the forward function is capable of mapping the color control space gamut to the modified CIELAB gamut and the inverse function is capable of mapping the modified CIELAB gamut to the control color space gamut.

- 5 10. A method comprising:
obtaining a CIELAB space gamut from a CMY space gamut;
changing a lightness component of the CIELAB space gamut to form an enhanced CIELAB space gamut; and
transforming the enhanced CIELAB space gamut to form a CMYK space gamut.

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11. The method of claim 10, wherein obtaining a CIELAB space gamut from a CMY space gamut comprises:

transforming the CMY space gamut to obtain a CMYK space gamut by including a black colorant in the CMY space gamut; and

- 15 transforming the CMYK space gamut to form the enhanced CIELAB space gamut by printing a plurality of patches and measuring each of the plurality of patches to obtain the enhanced CIELAB space gamut.

12. The method of claim 10, wherein obtaining a CIELAB space gamut from a CMY space gamut comprises:

- 20 transforming a CMY space gamut to a CMYK space gamut by including a black colorant in the CMY space gamut to form the CMYK space gamut; and
transforming the CMYK space gamut into a CIELAB space gamut by computing the CIELAB space gamut from a model capable of mapping the CMYK space gamut into the CIELAB space gamut.

- 5 13. A method comprising:
obtaining a CIELAB space gamut from a CMYK space gamut obtained from a
CMY space gamut;
expanding the CIELAB space gamut by changing the lightness component of the
CIELAB space gamut; and
transforming the CIELAB space gamut into a second CMYK space gamut.

14. The method of claim 13, wherein changing the lightness component of the
CIELAB space gamut comprises:
linearly rescaling the lightness component of the CIELAB space gamut.

- 10 15. The method of claim 14, wherein linearly rescaling the lightness component in the
CIELAB space comprises:
computing a rescaling factor that is a function of an L_{min} , an L_{max} , and an L_{mincm} .

- 15 16. Apparatus for transforming a CMY space gamut into a CMYK space gamut
comprising:
a processing unit;
a memory unit coupled to the processing unit; and
software means operative on the processing unit for:
obtaining a CIELAB space gamut from a first CMY space gamut, the CIELAB
20 space gamut having a plurality of values and each of the plurality of values having a
lightness component;
expanding the CIELAB space gamut by changing the lightness component of at
least one of the plurality of values of the CIELAB space gamut; and
transforming the CIELAB space gamut into the CMYK space gamut.

- 25 17. The apparatus of claim 16, wherein the processing unit is a microprocessor.

18. The apparatus of claim 16, further comprising:

an imaging unit coupled to the processing unit and capable of receiving the CMYK gamut and rendering an image from the CMYK gamut.

19. The apparatus of claim 16, wherein the memory unit is a semiconductor memory.

5 20. A computer-readable medium having computer-executable instructions for performing a method comprising:

obtaining a CIELAB space gamut having a lightness component, the CIELAB space gamut is obtained from a CMYK space gamut which is obtained from a CMY space gamut;

10 expanding the CIELAB space gamut by linearly rescaling the lightness component in the CIELAB space gamut using an L_{\min} , an L_{\max} , and an $L_{\min\text{cmY}}$; and transforming the CIELAB space gamut into a second CMYK space gamut.

21. The computer-readable medium of claim 20, further comprising:
transmitting the second CMYK space gamut to an imaging unit.

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